

Quantum fluctuation effects on hyperfragment formation from Ξ^- absorption at rest on ^{12}C *

Y. Hirata^a, Y. Nara^b, A. Ohnishi^a, T. Harada^c and J. Randrup

Among various nuclear fragmentation processes, the hyperfragment formation from the Ξ^- absorption reaction at rest is of primary importance for understanding strangeness in nuclei. We have investigated the formation mechanism of single, twin, and double hypernuclei from the Ξ^- absorption at rest on ^{12}C by applying a recently developed microscopic transport model that augments Antisymmetrized Molecular Dynamics by the effect of quantum fluctuations as given by the Quantal Langevin model [1].

The Quantal Langevin treatment ensures that the dynamical evolution of the system leads towards quantum statistical equilibrium. Such dynamics can be described by the time evolution of a distribution function that satisfies a Fokker-Planck equation, and the equivalent time evolution of the complex wave-packet parameter $\{z_i\}$ of AMD is governed by a Langevin-type equation. In the resulting AMD-QL model, the usual AMD equation of motion for $\{z_i\}$ is modified to be of Langevin-type by the inclusion of the quantum fluctuations of the energy expectation value.

This new framework appears to be superior to AMD, since the incorporation of the quantum fluctuation of the energy leads to a significantly improved description of particle evaporation and fragmentation, a feature expected to be especially important for the Ξ^- absorption reaction because the low degree of excitation renders the fluctuations especially important.

* LBNL-41023: Progress of Theoretical Physics (subm.)

^a Division of Physics, Graduate School of Science, Hokkaido University, Sapporo 060, Japan.

^b Advanced Science Research Center, Japan Atomic Energy Research Institute, Tokai, Ibaraki, 319-11, Japan.

^c Department of Social Information, Sapporo Gakuin University, Ebetsu 069, Japan.

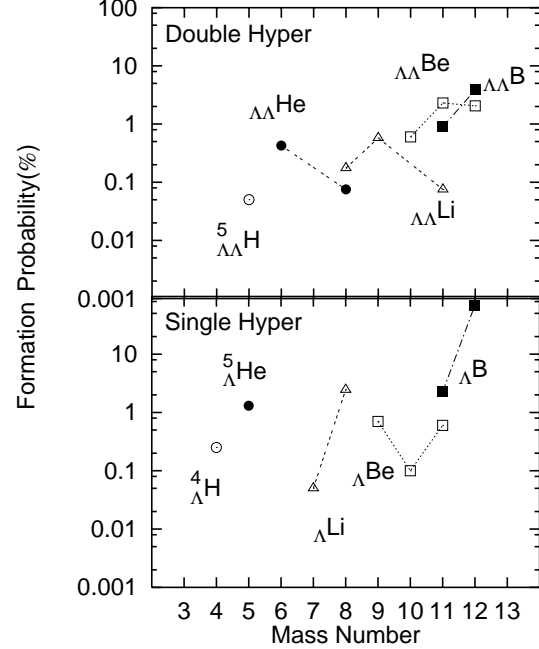


Figure 1: Calculated double and single hyperfragment mass distribution from Ξ^- absorption at rest on ^{12}C , after the dynamical AMD-QL stage is followed by statistical decays.

Our studies of the dynamical mechanisms for Λ emission and twin hyperfragment formation in the Ξ^- absorption reaction show that while pure AMD gives large production probabilities for double hypernuclei and cannot describe twin hyperfragment formation in the dynamical stage, AMD-QL suppresses the formation of double hypernuclei and achieves a qualitative description of twin hyperfragment formation. Furthermore, the dynamical AMD-QL simulations reveal that the twin hyperfragment formation reflects the initially given 3- α cluster structure of ^{12}C .

- [1] A. Ohnishi, J. Randrup, Phys. Rev. Lett. 75 (1995) 596; Ann. Phys. 253 (1997) 279; Phys. Lett. B394 (1997) 260; Phys. Rev. A55 (1997) 3315R.